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WATER QUALITY CONTROL STUDY AND PUBLIC HEALTH ASPECTS OF THE UPALCO UNIT, CENTRAL UTAH PROJECT, UTAH

Public Health Service,
Denver, Colorado

June 1965

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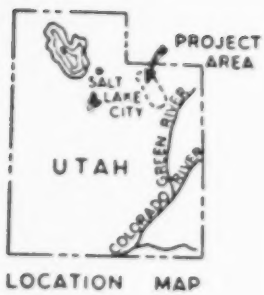
UTAH



LOCATION MAP

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PUBLIC HEALTH SERVICE, REGION VIII
DENVER, COLORADO

JUNE 1965

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WATER QUALITY CONTROL STUDY
and
PUBLIC HEALTH ASPECTS
of the
UPALCO UNIT, CENTRAL UTAH PROJECT

ABSTRACT

A survey has been made of the Upalco Unit which discloses that there is no apparent need for storage for streamflow regulation for the purpose of water quality control. This conclusion is based on results of economic and demographic studies which indicate that future waste loadings will not impair water quality for present and projected water users in the area.

Prepared at the request of and in cooperation with the Bureau of Reclamation, Region 4, U. S. Department of the Interior, Salt Lake City, Utah

U. S. Department of Health, Education, and Welfare
Public Health Service
Division of Water Supply and Pollution Control
Region VIII

June 1965

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INTRODUCTION

Request and Authority

The Bureau of Reclamation, Region 4, Department of the Interior, in a letter dated August 14, 1962, requested the Public Health Service, Department of Health, Education, and Welfare, to participate in the Bureau's project planning as set forth in the Federal Water Pollution Control Act, as amended (33 U.S.C. 466 a(b)). Further, in accordance with a memorandum of understanding dated September 28, 1956, between Region 4 of the Bureau of Reclamation and the Public Health Service, consideration has been given to the general public health aspects of the Bureau of Reclamation Central Utah Project, Upalco Unit.

Purpose and Scope

General objectives of the water quality control study are to assess the probable effects of the proposed project on water quality in local streams and reservoirs; to ascertain the benefits or harm resulting from changes in water quality; to assess the suitability of the water for proposed water uses; and to determine the need for and the value of storage for regulation of streamflow for the purpose of water quality control. The study covers Duchesne County in northeastern Utah. The need for streamflow regulation was studied not only for the present conditions, but also for anticipated future conditions in the year 2060.

Since this study has been made in advance of any comprehensive study of the Colorado River Basin, the findings presented are preliminary and subject to revision upon completion of comprehensive studies for water supply and water quality management in the Colorado River Basin.

The report includes the results of a study of general public health aspects and insect vector control of the project. The insect vector control section, prepared jointly by the Utah State Department of Public Health and the Communicable Disease Center, Public Health Service, Greeley, Colorado, presents a preliminary evaluation of the insect vector problems that may be associated with the project.

Acknowledgements

The assistance and cooperation of many state and federal agencies and individuals are gratefully acknowledged by the Public Health Service. Particular appreciation is expressed to the following for data and advice furnished by their staff members:

U. S. Bureau of Reclamation, Region 4
Regional Office, Salt Lake City, Utah
Provo Projects Office, Provo, Utah

Utah State Department of Health
Salt Lake City, Utah

Fish and Wildlife Service
Bureau of Sport Fisheries and Wildlife
Salt Lake City, Utah

PART A

WATER QUALITY CONTROL STUDY

I. SUMMARY OF FINDINGS AND CONCLUSIONS

Summary of Findings

1. The Bureau of Reclamation's Upalco Unit of the Central Utah Project is located in northeastern Utah in Duchesne County and will provide supplemental irrigation water for Indian and non-Indian agricultural lands. High runoff from spring snowmelts will be impounded in proposed Lake Fork Reservoir on Lake Fork River.

2. The irrigated lands are located in the semiarid area between the Duchesne River and the Uinta Mountains west of Roosevelt, Utah. This area lies north of the Duchesne River and is included in the Duchesne River Basin.

3. By most economic measures, this is a declining area. Population for the basin is presently (1965) 6,700 and has been decreasing for most of the past forty years. Incomes remain below the state and national average. Livestock grazing and dairying are the most important economic activities. The area is not blessed with any resources that at the present time give promise of a change in this rather bleak economic outlook.

4. Waste discharges are presently contributed by the towns of Roosevelt and Duchesne. Mineralization of the water results from irrigation returns and natural drainages.

5. Water originating in the mountains which will be used for irrigation has a flow weighted total dissolved solids (TDS) concentration between 30 and 35 milligrams per liter (mg/l). The water quality in streams draining the project has a flow weighted TDS concentration ranging from 250 to 1,640 mg/l. The groundwater system, which has a TDS range of 120 to 700 mg/l, is the water supply for nearly all public and private users since surface supplies are generally of poorer quality.

Conclusions

1. Evaluation of employment opportunities and potential resource development indicates a continued decline in population.

2. Under project conditions, an increase in the TDS load in the Duchesne River at Randlett of one-fourth of 1 percent and in the Green River of one-third of 1 percent is expected. The effect of the increase is presently indefinable since downstream use is primarily limited to irrigation. Water resource developments in this area will contribute, however, to the cumulative deterioration of water quality downstream.

3. With adequate waste treatment facilities for the towns of Duchesne and Roosevelt, present streamflows are sufficient to assimilate the projected waste loads from these population centers.

4. Based on information available, there is no need foreseen for inclusion of storage in the project reservoirs for regulation of streamflow for the purpose of water quality control.

II. PROJECT DESCRIPTION

The structural features of the project are shown in Figure 1 located at the end of the report. The features are as follows:

1. Lake Fork Diversion Dam, located on Yellowstone Creek, will divert high runoff water into Lake Fork Feeder Canal.

2. Lake Fork Feeder Canal, with a capacity of 200 cubic feet per second (cfs), will transport waters from Yellowstone Creek to Lake Fork Reservoir.

3. Lake Fork Dam and Reservoir, with an active capacity of 64,000 acre-feet (AF), will retain the water plus excess flow from Lake Fork for future use.

4. Tawanta Dam and Reservoir, with an active capacity of 2,000 A.F. will retain surplus runoff and allow ten high mountain lakes to be used for recreation rather than for storage.

The surplus winter and high spring flows of Yellowstone Creek, spills from Moon Lake Reservoir, and inflows between Moon Lake Reservoir and Lake Fork Reservoir will be impounded in Lake Fork Reservoir. Supplemental irrigation water for approximately 28,500 acres of non-Indian lands and 15,070 acres of Indian lands will be obtained from Lake Fork Reservoir.

Regulation and storage of Lake Fork irrigation water will be operated in conjunction with the recent privately constructed Big Sand Wash Reservoir and also Moon Lake Reservoir. Big Sand Wash Reservoir is owned by the Moon Lake Water Users' Association and has an active capacity of 12,000 AF. Moon Lake has an active capacity of 36,000 AF.

III. AREA DESCRIPTION

The Upalco Unit is in northeastern Utah just west and north of the town of Roosevelt, which is nearly 130 miles east of Salt Lake City via Route 40. The project lies in Duchesne County north of U. S. Route 40, the main transportation artery through the area. The project lands drain south into the Duchesne River between river mile 20 and river mile 60 and then into the Green River, a tributary to the Colorado River. Twenty-five miles north of the Duchesne River is the Uinta Mountain range.

Between the Duchesne River and the Uinta Mountains and between Roosevelt and the town of Duchesne lies the agricultural land which will receive the proposed supplemental irrigation water. This land ranges in elevation from 5,200 feet near the river to 6,800 feet near the mountains. The watershed supplying supplemental water for the existing and proposed irrigation system is in the Uinta Mountains which range in elevation from 8,000 feet to 13,000 feet.

The annual precipitation over the agricultural area is about 7.5 inches, whereas on the watershed the precipitation is nearly 19 inches a year. The growing season in the agricultural lands is approximately 120 days a year.

IV. WATER RESOURCES OF THE STUDY AREA

Water Supplies

The town of Duchesne receives its water supply from wells upstream and adjacent to the Duchesne River. Summer and winter grab samples of this water supply revealed a specific conductance at 25°C (Ec) reading of 850 and 825 micromhos/cm, respectively. The design capacity of this water treatment plant is 416,000 gallons per day. Roosevelt receives its water from a newly constructed system in which water originates from springs, while the old wells will be used for standby purposes. Summer and winter grab samples of this supply indicate an Ec value of 440 and 460, respectively. The groundwater reservoir provides most of the water for private and public water via wells and springs. This supply ranges in TDS from 120 to 700 mg/l, thus providing, in most cases better quality water than the surface streams.

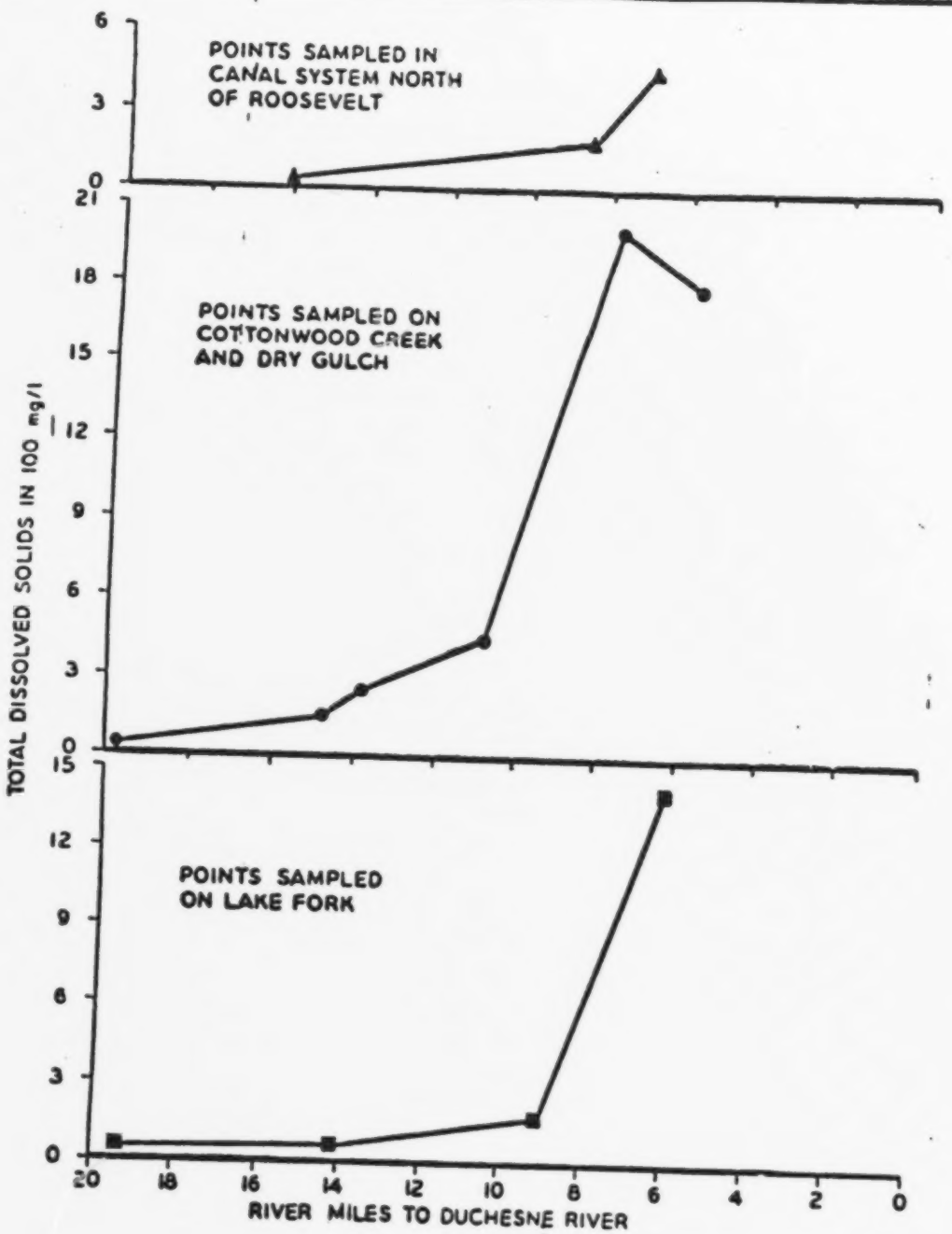
Water Quality

Since surface and impounded waters will be used primarily for irrigation, the water quality parameters of significance for this use are the mineral ions. Total dissolved solids will be used to represent mineral quality because the individual ion concentration does not vary significantly from the levels expected of the water in this area.

Water originating in the Uinta Mountains has excellent quality compared with the quality of runoff in the lower agricultural lands. The impounded water that will be used for irrigation has an annual flow weighted mean TDS concentration between 30 and 35 mg/l. This water includes surface water runoff from snowmelt and also that groundwater runoff tributary to the reservoir.

Water quality becomes progressively poorer as one traverses south from the mountains toward the Duchesne River. Readings indicating the specific conductance at 25°C in micromhos/cm were taken from irrigation water as it was found in feeder canals, laterals, and also natural drainages which collect irrigation returns for further use or discharge to the Duchesne River. The conductivity readings were converted to TDS values by means of the graph in Appendix A relating these two parameters for this area. Figure 2 relates this water quality in terms of TDS to the stream miles from the Duchesne River for three different watercourses. These data were grab samples which give an instantaneous but relative picture. This trend does not conflict with long-term data compiled in Table 1. Location of sampling points for the data represented on Figure 2 and Table 1 are shown in Figure 3.

The effect of the TDS load upon the Duchesne River is demonstrated by Figure 4. This plot compiled from 43 years of records, 1914 to 1957,

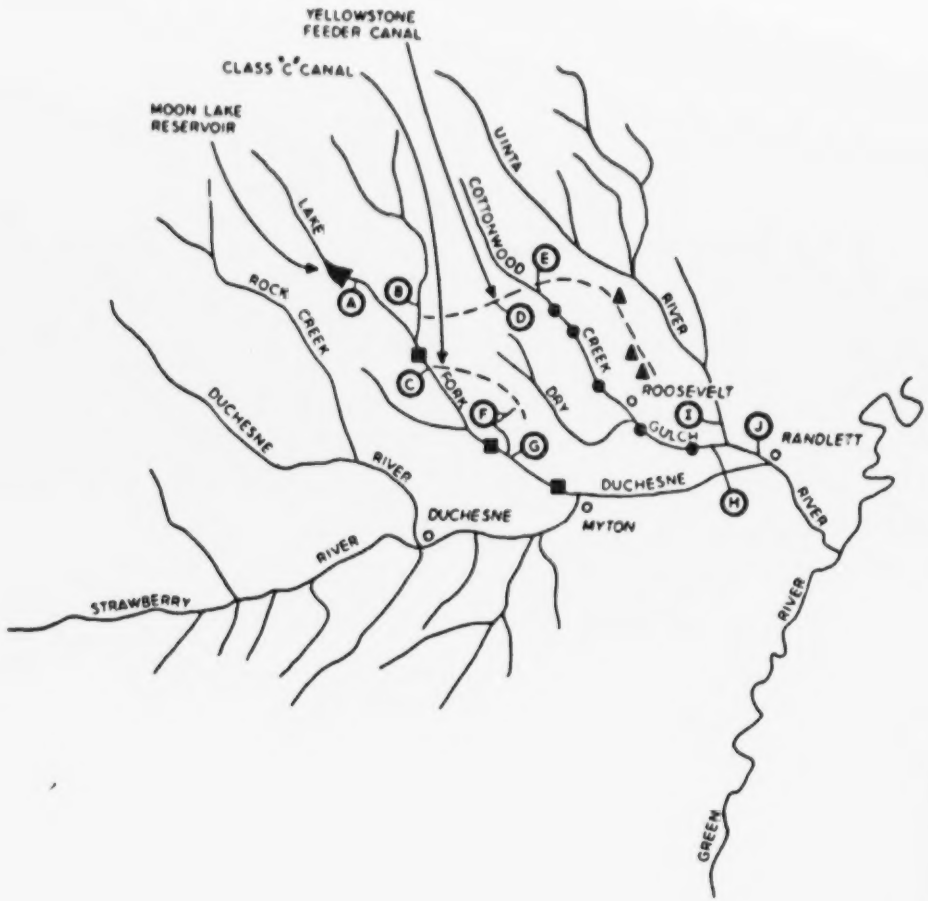


WATER QUALITY CONTROL STUDY
DRY GULCH AND LAKE FORK BASINS
OF THE DUCHESNE RIVER

TOTAL DISSOLVED SOLIDS CONC. BY MILES FOR VARIOUS STREAMS

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
Public Health Service
REGION VIII
DENVER, COLO.

FIGURE 2



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LEGEND

- ■ SAMPLING POINTS ON LAKE FORK
- ● SAMPLING POINTS ON COTTONWOOD AND DRY GULCH
- ▲ SAMPLING POINTS ON CANAL SYSTEM
- Ⓐ SAMPLING STATION RECORDED IN TABLE I

WATER QUALITY CONTROL STUDY
DRY GULCH AND LAKE FORK BASINS
OF THE DUCHESNE RIVER

LOCATION OF SAMPLING POINTS

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
Public Health Service
REGION VIII DENVER, COLO.

FIGURE 3

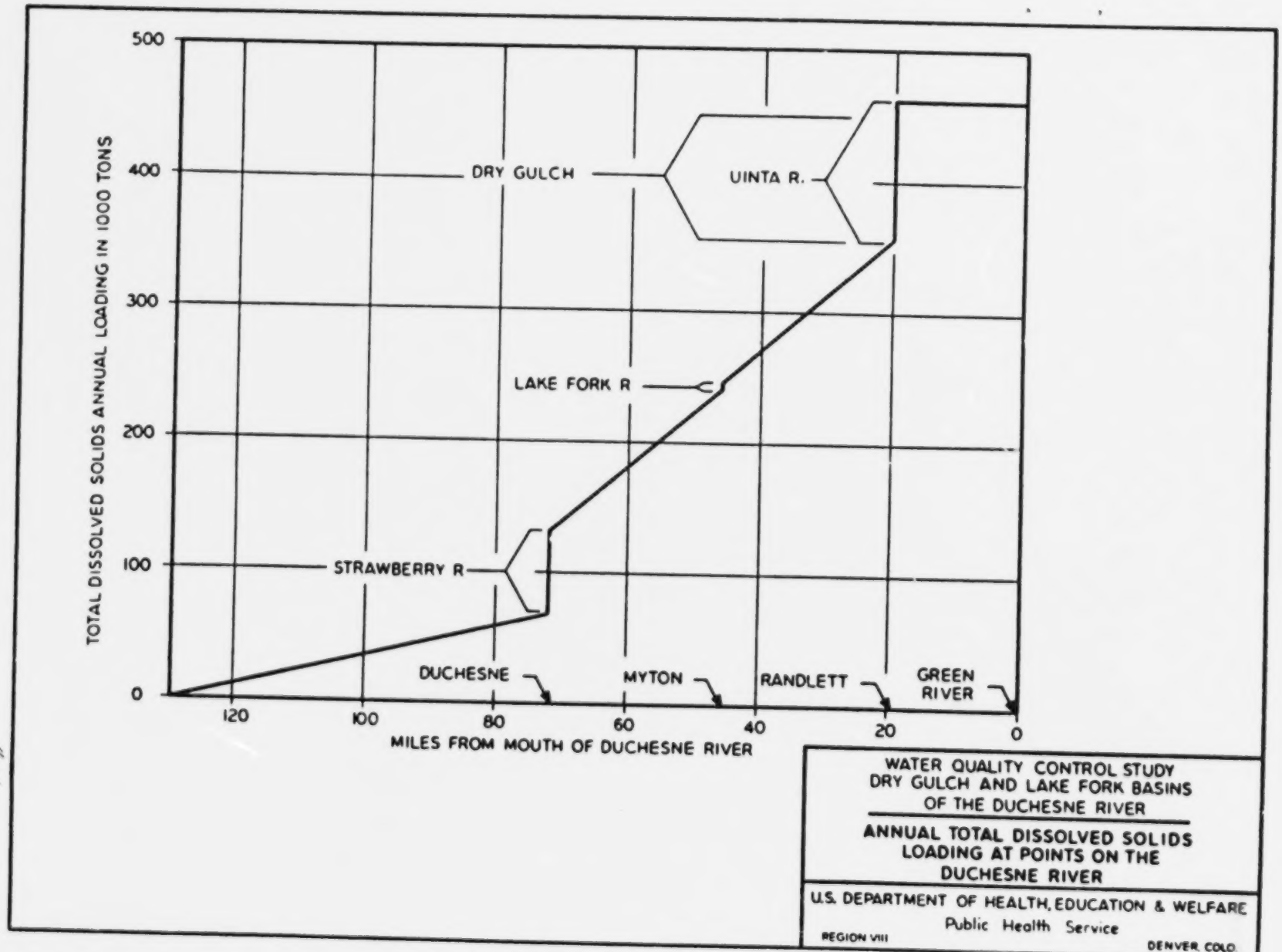
7.8

shows the river miles from the mouth of the Duchesne River vs. the annual TDS loading in the river. A substantial amount of the drainage from river mile 20 to river mile 60 comes from lands north of the river, i.e. from the lands containing the project area. Between the towns of Randlett and Duchesne, the flow increases 140 percent, but the TDS load increases 560 percent. Figure 4 reveals that Dry Gulch, which drains about one half of the project area, contributes heavily to the TDS load in the Duchesne River. Lake Fork River which drains the other one half of the project lands is highly diverted for irrigation, therefore, the TDS load by surface runoff from Lake Fork is small. However, since there is a large TDS loading not accounted for by a specific tributary to the Duchesne, and since most of the drainages come from the north, it is assumed the major TDS loading from the Lake Fork Drainage Basin finds its way to the Duchesne by sub-surface drainage.

The water quality and quantity from the Duchesne Basin experiences the common seasonal variations. The spring snowmelt and precipitation gives a high runoff of good quality, as is set forth in Figure 5. It should be noted that although the runoff in May and June has a very low TDS concentration compared with the remaining ten months of the year, the flow is of such a magnitude that over 48 percent of the TDS removed from the basin occurs during these two months.

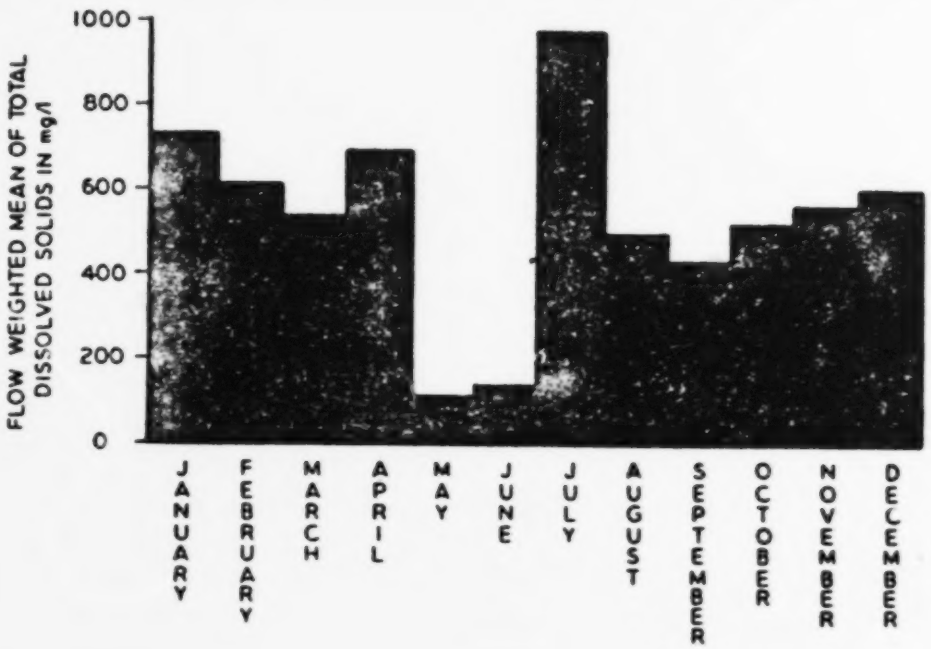
On the basis of 43 years of records, 1914 to 1957, the weighted average TDS concentration of the Green River just above the confluence with the Duchesne is given as 392 mg/l, whereas the Duchesne River has weighted average TDS concentration of 608 mg/l. In other terms, the annual TDS loading from the Duchesne River Basin is 118 tons per square mile, whereas the annual TDS loading in the Green River is represented by 68 tons per square mile. These data show where the Duchesne River stands in relation to the other river basins in the area as far as TDS pollution is concerned.*

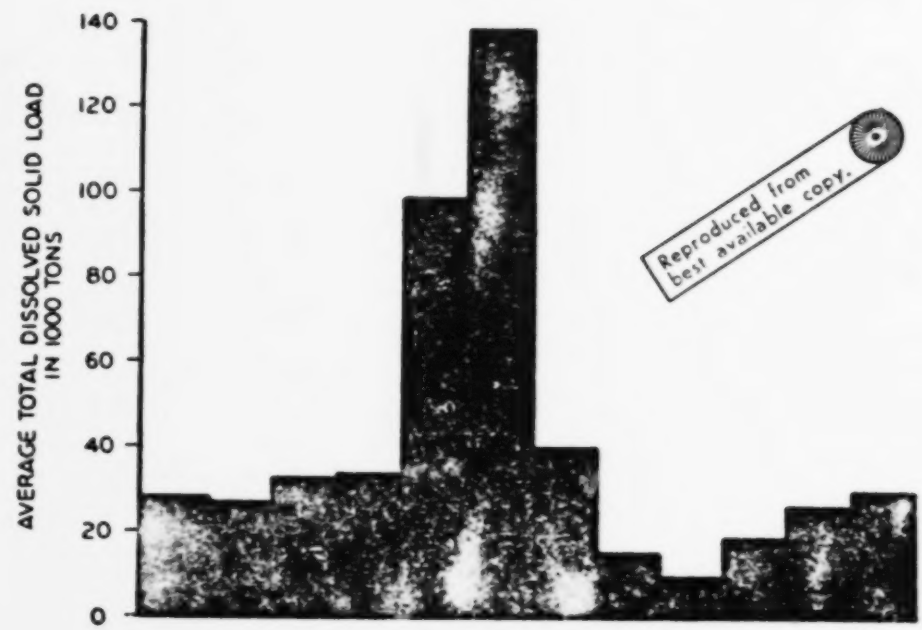
*Data taken from Table 6, page 22, "Quality of Water Upper Colorado River Basin Progress Report" January 1963, Geological Survey, U, S. Department of Interior


500
400
300
200
100
0
TOTAL DISSOLVED SOLIDS ANNUAL LOADING IN 1000 TONS
DRY GULCH
UINTA R.
LAKE FORK R
STRAWBERRY R
DUCHESNE
MYTON
RANDLETT
GREEN RIVER
120
100
80
60
40
20
0
MILES FROM MOUTH OF DUCHESNE RIVER
WATER QUALITY CONTROL STUDY
DRY GULCH AND LAKE FORK BASINS
OF THE DUCHESNE RIVER
ANNUAL TOTAL DISSOLVED SOLIDS
LOADING AT POINTS ON THE
DUCHESNE RIVER
U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
Public Health Service
REGION VIII
DENVER, COLO.

H-8

FIGURE 4





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WATER QUALITY CONTROL STUDY
DRY GULCH AND LAKE FORK BASINS
OF THE DUCHESNE RIVER

MONTHLY LOAD AND AVE CONC. OF TOTAL DISSOLVED SOLIDS FOR DUCHESNE RIVER NEAR RANDLETT

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
Public Health Service
REGION VIII DENVER, COLO.

8-B

FIGURE 5

TABLE 1

FLOWS AND TOTAL DISSOLVED SOLIDS CONCENTRATIONS
FOR STREAMS IN THE UPALCO AREA

Field Location	Map Location*	Sampling Period	Number of Samples	Mean Total Dissolved Solids-mg/l	Extreme** TDS-mg/l	Mean Flow cfs	Extreme** Flow-cfs
Lake Fork River at Lake Fork Dam Site	A	6- 7-63 4-30-64	9	27.9	215 18	171	500 10
Yellowstone Creek at USGS Station Altonah	B	5- 7-59 9-30-63	16	37.7	88 20	158.1	444 6
Lake Fork at "C" Canal Heading	C	4-30-58 7-30-64	35	39.9	193 11	142	500 4
Dry Gulch at Yellowstone Feeder Canal	D	6- 5-63 6-10-64	4	77	137 67	17.5	50 4
Cottonwood Creek at Yellowstone Feeder	E	8-30-63 7-30-64	8	622	740 474	0.2	0.25 0.0
Big Sand Wash north of Upalco	F	8-15-56 7-30-64	28	139.5	532 66	24.6	60 4
Lake Fork River at Highway U-86	G	4- 7-64 7-30-64	6	256	692 146	22.7	50 2
Dry Gulch near Fort Duchesne	H	11- 8-55 8- 4-64	40	1640	3154 810	57.8	300 12
Uinta River above Dry Gulch	I	2- 8-61 8- 4-64	12	311	1294 63	33.6	200 1
Uinta River at Mouth	J	4- 2-64 8- 4-64	7	1115	2926 681	133	500 20

* Located in Figure 3.

** Upper number represents high extreme and lower number represents low extreme as taken from data furnished by the Bureau of Reclamation.

V. THE ECONOMY

The Upalco Unit of the Central Utah Project is located in east central Duchesne County in the northeastern part of Utah. Duchesne County lies largely within the Uinta Basin, a semiarid area bounded on the north by the Uinta Mountains which include the highest peak in Utah and five other peaks above 13,000 feet elevation. A little more than 40 percent of the area of the county is in national forest or managed by the Bureau of Land Management, and about one-fourth is held in Indian reservation. The population is classified as entirely rural by the Bureau of Census. Roosevelt is the largest town with 1,812 people in 1960; Duchesne, the county seat, has a population of 770; and Myton the third largest town, 329. Although the county comprises 4 percent of the land area of the state of Utah, less than three-quarters of 1 percent of the state's population lives there; and these people earn only one-half of 1 percent of the state's income. The following analysis of the development of economic activity in the study area and the potential for future growth has been prepared as an indication of future water needs and expected waste loading.

Economic Activities

Agriculture has long been, and remains the major industry of the area with 27.6 percent of the labor force so employed (Down from 60 percent in 1940) compared to 6 percent for the state as a whole. Thirty-two percent (or 658,078 acres) of the total land area of the county is used for farming. Of this land in farms, the major portion, 521,709 acres, is used for grazing livestock. The irrigated land acreage (48,438 acres), however, accounts for nearly one-half of the estimated two and a half million dollar value of the farming land in the area.(1)

Livestock and livestock products are the most important element in this agricultural economy. Dairying is the source of almost one-half of the nearly six million dollar total annual income from agricultural production in the county. The sheep industry has been a principal economic stabilizer of the area although a relatively few individuals own most of them. More than 40,000 sheep are sold each year.

The production of cattle employed 16 percent of the total labor force of the county in 1959. In the past few years a lack of feed on drought-barren winter rangeland has reduced the number of range cattle from 18,000 in 1955 to 13,500 in 1962.

Crop production which includes alfalfa, corn and small grains, such as wheat, oats, and barley, is mainly to support the livestock industry. The number of farms has decreased from 947 in 1949 to 743 in 1959 while the average size of farms also decreased from 764 acres to 745 acres.

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The value of crops sold has decreased from $671,000 in 1949 to $495,000 in 1959. Value of livestock products sold have increased from $3,136,000 to $4,372,000 in the same period.(1)

Mining, which employs 4.2 percent of the labor force, is somewhat less important than in the state as a whole, though the percentage of people working in this industry is increasing (from 2.1 percent in 1940 and 3.0 in 1950).(2) In 1962 the total value of mineral production was $272,000, the most important being sand and gravel followed by petroleum and natural gas. The value of mineral production fluctuates widely from year to year. Petroleum is the most consistently produced mineral though the total amount remains small, ranging from less than 7,000 barrels in 1961 to more than 34,000 barrels in 1963.

Employment in manufacturing remains significantly below that of the state and nation. (see Figure 6) Less than 5 percent of the labor force in Duchesne County is engaged in manufacturing and has shown little tendency to increase since 1940. By contrast, 16 percent of the workers in the state and 27 percent in the United States are employed in manufacturing. Such industry as does exist is mostly agriculturally oriented and small - a seed company and a feed company each employing about 7 people, a dairy employing 29, a creamery employing 4, a livestock sales barn employing 2-19, and a meat packing company employing 4 men.

Employment in construction has risen above the state share (9.2 percent compared to 6.9 percent for the entire state). The proportion employed in trade and services remains below the state percentage as does employment in utilities, communications, transportation, finance, real estate, and government.

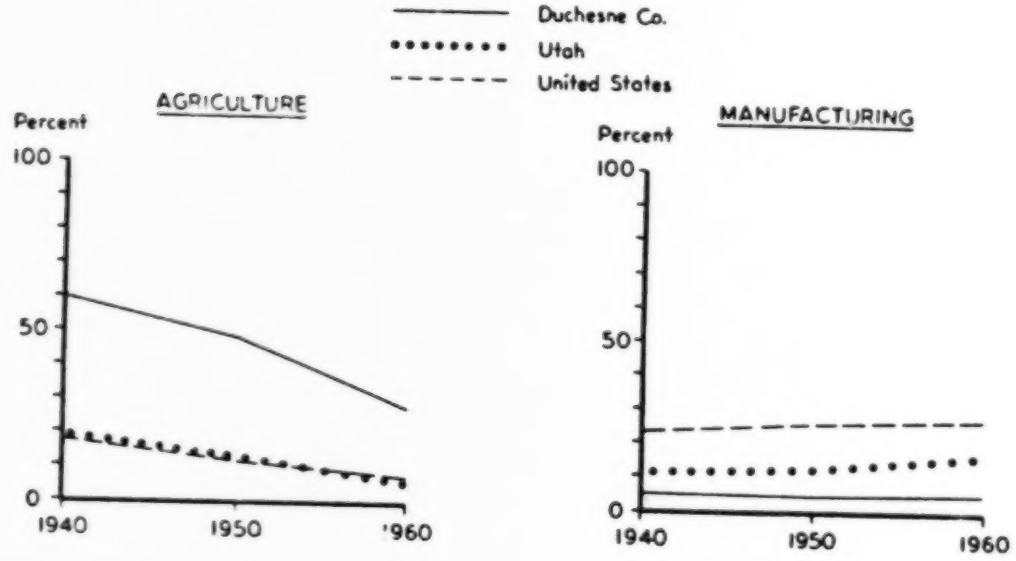
Income in the area is somewhat below the level for the state as a whole. In 1960 the median family income in Duchesne County was just 79 percent of the median family income in Utah. The per capita disposable income of the county, $1,088, was also considerably less than the per capita income of the state, $1,735.

The picture drawn above is not that of a thriving, vital economy, nor is the outlook for the future much brighter. The economy of the area is narrowly based upon agriculture with little diversification, and agriculture is generally a declining sector of the nation's economy. The dairy industry, already important in the area, may increase as the urban centers around Salt Lake City, 130 miles to the west, grow in size. Powdered milk and cheese are currently being exported to markets as far away as California. The short growing season and the cold dry springs which characterize the area are not conducive to the growing of cash crops, hence it is likely that the basis of the economy will remain livestock growing. Additional water made available by this project is not expected to draw more families into the area, though it may improve the living standard of those already there to some degree.

EMPLOYMENT IN AGRICULTURE AND MANUFACTURING

Duchesne County compared with Utah and the United States

(Percent of total labor force)



POPULATION TREND

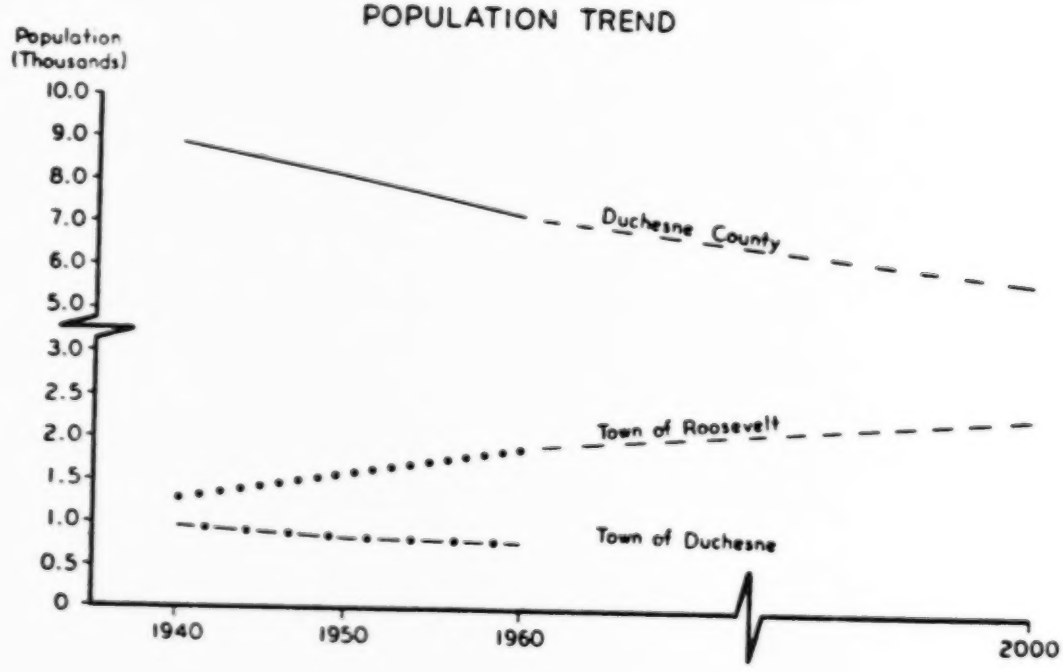


FIGURE 6

Production of petroleum has grown moderately in the past several years. Development of a 1,073 barrel-a-day well in the spring of 1964 in the southeastern part of the county gives some encouragement of future expansion of this industry.(3) It is believed that the area is underlain by large quantities of oil shale, but development of the shale oil industry remains an "iffy" proposition and even if this industry should burst into bloom, Duchesne County is somewhat remote from the probable center of activity and would benefit only marginally, if at all. There is some gilsonite and coal present, but development on a large scale is unlikely, although the more distant future for coal may be brighter than the present.

The Uinta Mountains are an attractive area with some potential for development as a tourist and recreation area. However, present facilities for these activities are very limited and access roads remain primitive. Areas to the east and west are much more developed (and better endowed) as recreation centers, and it is not felt that the study area will be able to compete successfully with them in this activity A recent study of the Green River Basin found the impact of recreation on the economy of Duchesne County to be among the smallest in the basin.(4)

One transcontinental highway, U. S. 40, traverses the area. This highway, however, has not been designated as a part of the interstate highway system. The completion of interstate highways 80 (U. S. 30) to the north and 70 (U. S. 50) to the south of the area may reduce the traffic in and out of the area. Additionally, although not close enough to the urban centers of Salt Lake City and Provo to share in their growth, the study area is not far enough from them to develop as an independent trade center or an overnight stopping place for travel to and from the urban centers. No railroad enters the area.

Freight rates to the area are not advantageous, nor does finance capital appear to be readily available to encourage growth.(5)

Demographic Trends

Population trends in the area reflect the limited employment opportunities available there (see Figure 6). Population density is only 2.2 people per square mile compared to 10.8 per square mile for the state of Utah and 50.5 for the United States. The number of people living in Duchesne County has decreased by 20 percent since 1940 to 7,179 people in 1960, and to 6,700 in 1965. The only community in the county which is growing in size is Roosevelt, which is growing at the rate of 2 percent a year. There do not appear to be any forces on the economic horizon which will change this emptying out trend, though the rate of outmigration will likely slow down as the population approaches a working minimum. The town of Roosevelt as the trade and transportation center for the area will likely continue to grow, perhaps to as much as 2,800 people by the year 2000, and 3,500 by 2060. Although the entire population of the county

is classified as rural by the Bureau of Census, only 42 percent is listed as rural-farm population. Analysis of the population by age groups reveals that the greatest loss of people has been of the 15 to 29 years-old group. There has been a less marked decline in the numbers in the 30-44 years-old group and increases in the portion of the population made up by the less than 14 year-olds and the over 45 years-old group. Thus the people leaving the area have been of the most active working ages.

Projection of Future Population

	1960	1980	2000	2030	2060
Duchesne County	7,179	6,000	5,800	5,600	5,500
Roosevelt town	1,812	2,300	2,800	3,200	3,500
Percent of population that is rural-farm	42%		35%		20%

Although a significant portion of the land of the county is in the Uinta and Ouray Indian Reservation, the center of the Indian population appears to be outside the county to the east. Only 5 percent of the population in the county is Indian.

The evidence developed in this economic study suggests that water usage in the study area will remain agricultural with little if any increase in municipal and industrial requirements. There is little hint of additional activity that would create new waste treatment problems with the exception of growth of the town of Roosevelt and this will not be large.

VI. WATER QUALITY CONTROL

Under provisions of the Federal Water Pollution Control Act, as amended (33 U.S.C. 466 et seq), in the survey or planning of a reservoir by any Federal agency, consideration must be given to the inclusion of storage for regulation of streamflow for the purpose of water quality control. It is expressly stated that any such storage shall not be provided as a substitute for adequate treatment or other methods of controlling wastes at their sources.

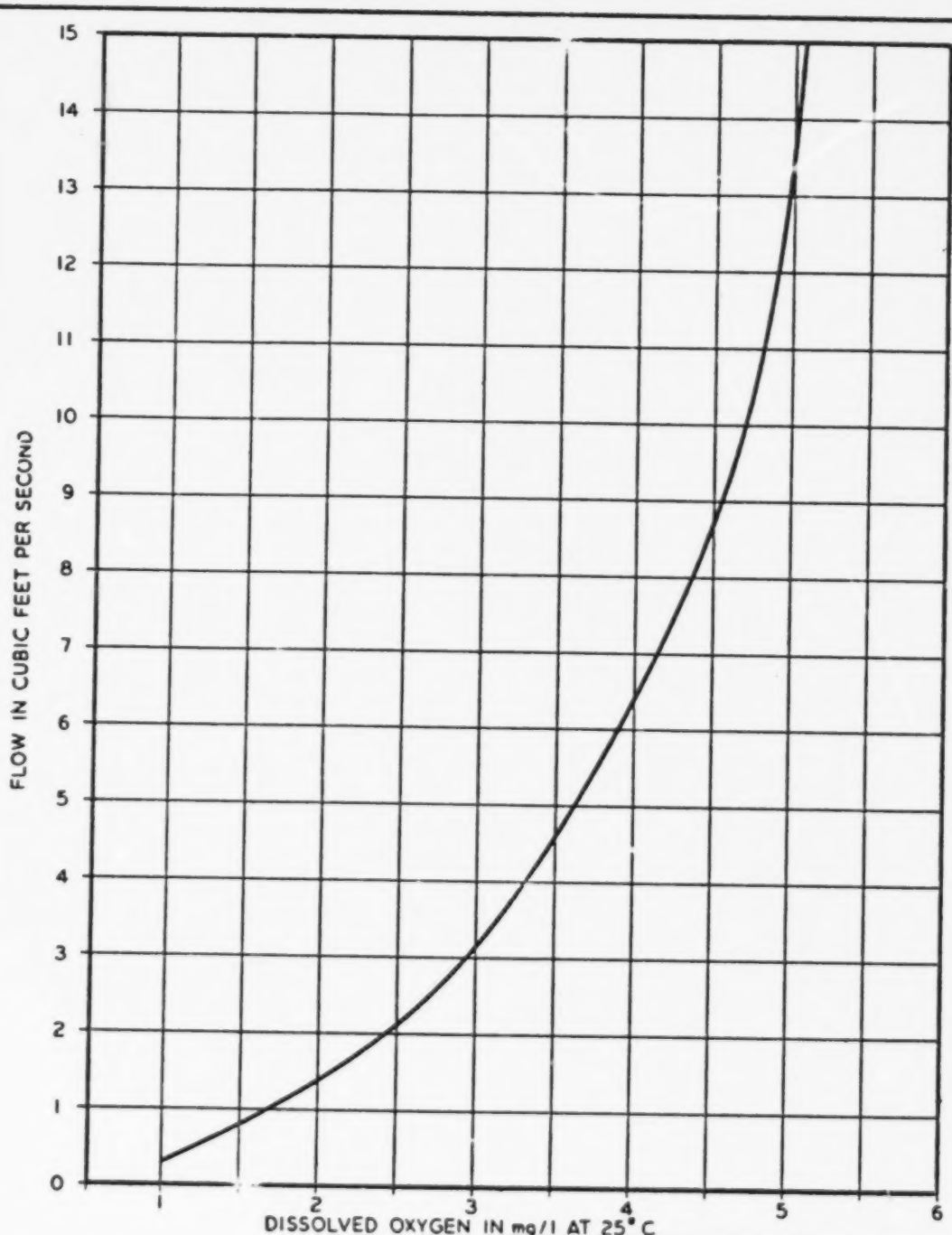
Domestic waste at Duchesne is treated in an Imhoff Tank which discharges into the Strawberry River just upstream from the Duchesne River. The domestic waste treatment facilities at Roosevelt are overloaded at the present time with the inadequately treated waste discharging into Cottonwood Creek about two miles upstream from Dry Gulch. There are visible signs of pollution in Dry Gulch such as sludge deposits containing species of pollution tolerant organisms. These species were present in large numbers.

At present there are two milk processing plants in the project area. If the project is put into operation, a likely agricultural product will be fodder for dairy cattle resulting in increased milk processing. The industrial waste from these plants will present no problem if 85-90 percent of the five day 20°C biological oxygen demand (BOD) is removed by adequate treatment processes prior to discharging to Cottonwood Creek.

Presently the only pollution problem in the project area is from Roosevelt because of inadequate treatment. The wastes from the town of Duchesne with adequate treatment would not be a problem as determined by projected populations and industrial activity.

The area bordering the streams which receive waste from Roosevelt is primarily barren land settled with a few small farms. With many lakes and streams of high water quality in the nearby mountains, game fishing in a drainage such as Dry Gulch is unlikely. However, 4 mg/l of dissolved oxygen (DO) was considered desirable for protection of rough fish and general recreational use.

With Roosevelt providing adequate treatment, i.e., 85 percent removal of five day 20°C BOD, calculations reveal that present and projected flows in Cottonwood and Dry Gulch are sufficient to provide a minimum of 4 mg/l of DO. Figure 7 illustrates the flow which must be provided to maintain a given DO content at 25°C, the highest temperature expected during low flow periods for the reach of Cottonwood and Dry Gulch which will receive waste from Roosevelt. The calculations for this graph are based on the BOD remaining after adequate treatment for a population equivalent loading of 5,700 persons which was projected for the year 2060. Figure 7 indicates that 6.5 cfs will provide the desired DO content. Calculations reveal that these streams will provide a flow less than 6.5 cfs only once in fifty years.



WATER QUALITY CONTROL STUDY
DRY GULCH AND LAKE FORK BASINS
OF THE DUCHESNE RIVER

DISSOLVED OXYGEN FOR VARIOUS
FLOWS IN DRY GULCH AND
COTTONWOOD CREEKS AT 25°C

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
Public Health Service
REGION VIII DENVER, COLO.

FIGURE 7

14-F1

The project will provide 0.38 acre-feet of supplemental water to 28,500 acres of no-Indian lands which now receive 2.41 acre-feet. There will also be 15,070 acres of Indian lands receiving 0.06 acre-feet of water supplemental to 2.22 acre-feet now being received.1/ Since the quantity of additional water used for irrigation will be small, the resulting increase in TDS load will also be small. The computed TDS increase in the Duchesne River at Randlett is less than 2 mg/l or one-fourth of 1 percent, and at the same time the load in the Green River just below the confluence with the Duchesne is expected to increase about 1 mg/l or one-third of 1 percent. Increases in TDS loading are not of significant magnitude to cause damage to present or future water users downstream on the Duchesne River to its mouth.

Damages from increased mineral content of the water as a result of the project is presently indefinable and streamflows in the project area are adequate to handle organic wastes that have received adequate treatment before discharge. In view of these findings and since there are no beneficial uses of water downstream from Roosevelt to the Green River except for irrigation, there appears to be no need for storage in the project reservoirs for streamflow regulation for the purpose of water quality control.

To more adequately define the impact of this project and others on the overall water quality and water use in the Colorado River Basin, it is necessary to await the results of a comprehensive study of the Colorado River Basin as to water quality control.

1/ Information received from the Bureau of Reclamation

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PART B

PUBLIC HEALTH ASPECTS

I. SUMMARY AND RECOMMENDATIONS

Summary

1. Project development will improve the economy and permit the establishment of a more healthful environment.

2. Recreational development contiguous to reservoirs will be partially regulated by the topographical features of the shoreline.

3. Temporary construction camps will be necessary to serve the contractor's employees.

4. As overall watershed management involves many interests, it is essential that the effect on public health be fully coordinated with state and/or local health departments.

5. Mosquitoes are the principal vectors which might be affected by the proposed project, although other insects and rodents may be involved.

6. Provision for the prevention and control of man-made vector sources will increase the overall benefits of the project.

Recommendations

Overall watershed management requires the cooperation of many interests to assure that development and activities will minimize the potential public health hazards associated with the proposed project. It is recommended that the following be given due consideration in development of the Upalco Unit of the Central Utah Project:

1. That the water users' organization (i.e., Water Conservancy District) operating as the general administrative and contracting agency for the project should:

   a. Alert all water users of the potential public health hazards associated with using inadequately treated water for culinary purposes;

   b. Exert all possible precaution to exclude inadequately treated sewage and barnyard drainage from project canals, laterals, and drains;

   c. Wherever and whenever possible, assist the project inhabitants and communities in development of approved water and sewerage facilities; and

   d. Operate and maintain project facilities in accordance with established criteria.

2. That potential recreational areas be investigated and at least minimum water and sanitary facilities be provided in accordance with Utah State Department of Health regulations.

3. That a sanitary survey of proposed construction campsites be made and all camps be provided with water and sanitary facilities in accordance with Utah State Department of Health regulations.

4. That recreational activities, at reservoirs utilized as a source of public water supplies, meet the requirements established by the Utah State Department of Health.

5. That person or persons responsible for a public water supply establish suitable controls over the use of watershed areas tributary to the supply to insure production of raw water meeting the quality requirements established by the Utah State Department of Health.

6. As public health safeguards against vector-borne diseases, every possible effort should be made during the planning, construction, and operational phases of the proposed project to avoid creating conditions which will increase populations of mosquitoes and other arthropods and rodents of public health importance or increase the likelihood of exposure of humans to such vectors. It is therefore recommended that:

   a. Where applicable, the principles and practices for prevention and control of vector problems associated with reservoirs outlined in Appendix B be adhered to in the design, construction, and operation of the proposed project.

   b. Where applicable, the principles and practices for prevention and elemination of mosquito sources associated with irrigation outlined in Appendix C be adhered to in the development, operation, and maintenance of the project.

II. PUBLIC HEALTH AND RELATED PROBLEMS

Public Health Services

Project development will improve the economy of the area so that local residents benefiting either directly or indirectly will be in a position to enjoy a higher standard of living. Among other necessities, this involves the establishment of a healthful environment. Some of the more important factors in creating such an environment include the development of safe and ample culinary water supplies, proper waste disposal facilities, and insect and rodent control measures.

Recreational Development

Concomitant with the development of water resources comes the increased use of lands adjoining reservoirs for recreational purposes. This presents major problems of sanitation involving those of coordination of the multiple use policy and prevention of water pollution. The extent of recreational development, planned or spontaneous, immediately contiguous to reservoirs will be partially regulated by the topographical features of the shoreline. Also, a receding shoreline during the irrigation season, together with an accumulation of mud deposits above the water level, will create hazardous and undesirable conditions for some water-based recreational activities.

Construction Phase of Project

No housing accommodations are available in the vicinity of the construction site to serve the contractor's employees during the construction phase of the project. Under these conditions a temporary construction camp will be necessary. Prior to selection of a campsite a sanitary survey of the proposed area should be made by the State Department of Health or the Public Health Service to assist in solving of problems which may be encountered in connection with the installation of water and sanitary facilities.

Water supplies and sanitary facilities required in connection with temporary construction camps and with permanent housing for reservoir attendants should comply with the requirements of the Utah State Department of Health so as to eliminate potential health hazards.

Sanitary Aspects of Watershed Management

As overall watershed management involves many interests, it is considered essential that proposed developments and activities on watersheds pertaining to public health aspects be fully coordinated with state and/or local health departments. These matters should be mutually considered prior to the actual development of the watershed and issuance of permits.

Adequate and safe water and sanitary waste disposal facilities, in accordance with state and/or local health agency standards, should be provided in public use areas to serve camping, picnicking, and other recreational uses. Water and sanitary facilities for private dwelling sites should also meet the established health standards. The effectiveness of the sanitation program should be evaluated periodically by a detailed sanitary survey in conjunction with laboratory analyses of water samples collected from surface and/or groundwater in the watershed.

Preliminary Vector Evaluation

Anticipated Effects of the Proposed Project on Vector Problems

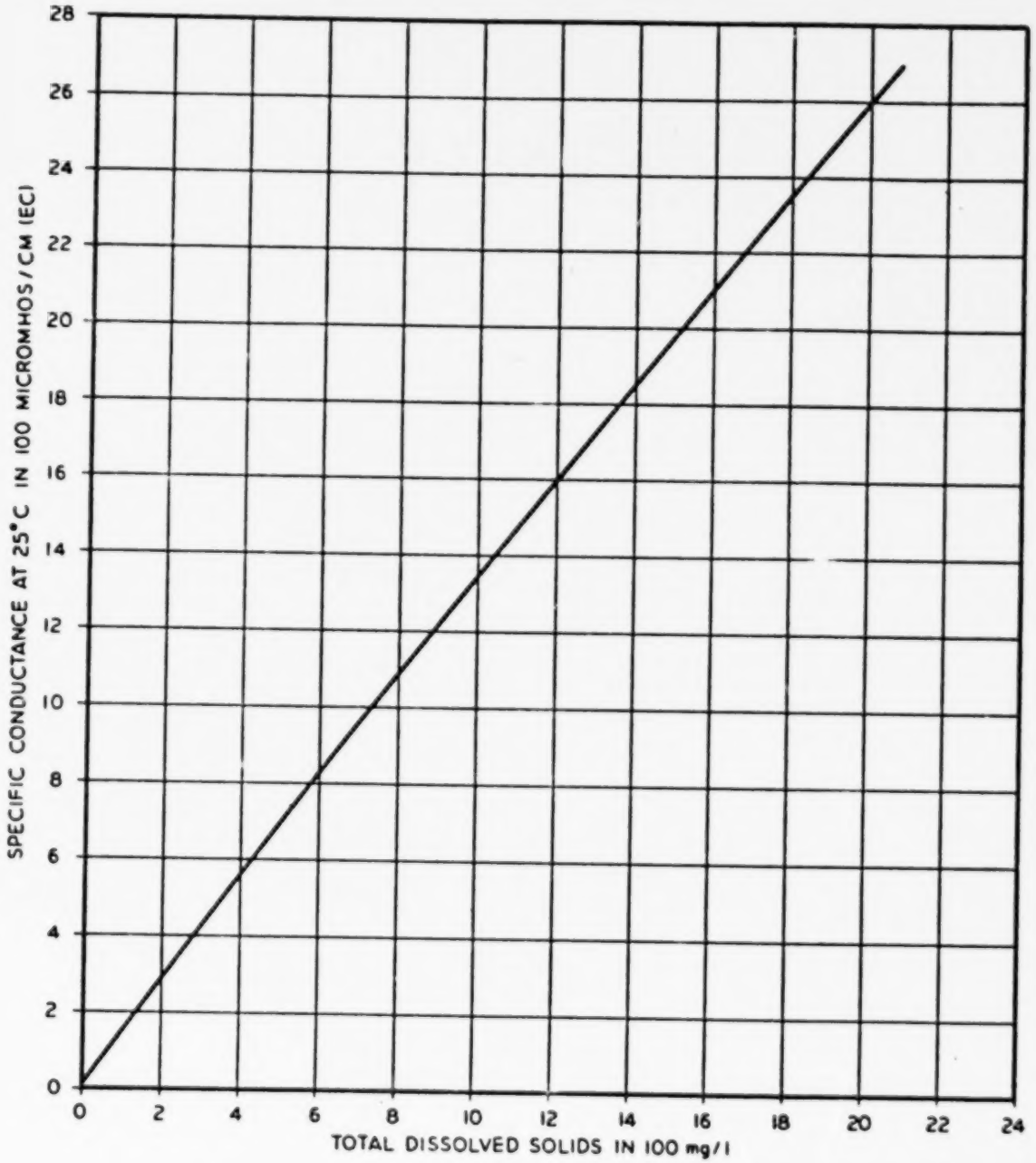
At present, mosquito production in the area of the proposed project is closely associated with irrigation agriculture and stems largely from the tendency of farmers to over-irrigate during early season when the supply of water is adequate. The surface runoff and seepage resulting from excessive application of water during early season, and the rather widespread use of vegetation-choked roadside ditches as drainageways, create numerous aquatic habitats favorable for the production of mosquitoes. Storage and regulation of irrigation water in the proposed reservoir should result in better irrigation practices and thereby benefit mosquito control in the project area.

It is anticipated that conditions favorable for the production of mosquitoes would occur in the upper reaches of the proposed Lake Fork Reservoir if flat or gently-sloping areas are shallowly inundated for extended periods during the summer or if marginal depressions are intermittently flooded as a result of fluctuating water levels. Also, mosquito production would be expected to occur in undrained seeps which develop below the dam. Conditions associated with the reservoir which are favorable for the production of mosquitoes could be minimized by proper clearing of the basin, selective shoreline conditioning, and installation of adequate drainage facilities. In the event recreational or public use areas are developed along the shores of the proposed reservoir, appropriate prevention and control measures for vectors of both aquatic and terrestrial origin should be carried out.

Responsibility for Vector Control

Responsibility for vector prevention and control is normally associated with land ownership or operating rights. Therefore, the agency, group, or individuals responsible for various aspects of the proposed project should be prepared to accept full responsibility for the prevention and control of vector problems resulting from the design, construction, operation, or maintenance of the project.

APPENDIX A



WATER QUALITY CONTROL STUDY
DRY GULCH AND LAKE FORK BASINS
OF THE DUCHESNE RIVER

SPECIFIC CONDUCTANCE VERSES TOTAL DISSOLVED SOLIDS FOR WATERS IN UPALCO UNIT

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
Public Health Service
REGION VIII DENVER, COLO.

APPENDIX B

Principles and Practices for Prevention and Control of Vector Problems Associated with Reservoirs

I. Prevention and Source Reduction Measures

A. For Mosquitoes and Other Aquatic Insects

1. All borrow pits and other potential ponding areas associated with construction of the dam, relocation of highways or roads, etc., which are located above maximum pool level should be made self-draining.

2. Prior to impoundage, the reservoir basins should be prepared as follows:

   a. The normal summer fluctuation zone of the permanent pool should be completely cleared except for isolated trees and sparse vegetation along abrupt shorelines which will be exposed to wave action.

   b. Dense stands of timber rooted below the normal summer minimum pool level but extending above that elevation should be cleared. In some situations, such timber may be felled and securely tied down in lieu of disposal.

   c. Borrow pits, depressions, marshes, and sloughs which will be flooded by the reservoir at maximum pool level and which would retain water at lower pool levels should be provided with drains to insure complete drainage or fluctuation of water within them.

   d. If the summer fluctuation zone of the permanent pool is limited to a few feet, consideration should be given to "building out" mosquito-producing areas located within flight range of population groups or recreational areas through the use of measures such as deepening and/or filling. This would minimize the need for repetitive measures for controlling vegetation and mosquito production.

3. After impoundage, the following maintenance measures should be carried out in all potential mosquito-producing areas located within flight range of human population groups or recreational areas frequented by significant numbers of persons:

   a. All dense vegetation should be removed periodically from flat, protected areas within the normal summer fluctuation zone of the permanent pool.

b. Vegetation, debris, and flotage should be removed periodically from all drains to insure free flows.

4. Water level management to minimize conditions favorable for mosquito production should be used to the maximum degree permitted by the primary purposes of the reservoir. This will minimize the need for repetitive measures for controlling vegetation and mosquito production.

5. As a general principle, waterside recreational areas, particularly those which have facilities for overnight human occupancy, should be located along sections of the reservoir which have a low production potential for mosquitoes and other aquatic insects of public health importance.

B. For Terrestrial Arthropods and Rodents at Recreational Areas

1. Proper storage, collection, and disposal of refuse should be practiced in order to prevent and control flies, wasps, other noxious insects, rats, wild rodents, and other small mammals.

2. All buildings should be rodentproofed at recreational areas where rodents are prevalent which may create public health hazards.

3. Debris, rubbish, and other materials which may serve as harborage for rodents and other small mammals should be removed periodically.

4. Brush and weeds along paths, trails, roadways, and other areas of frequent use by visitors should be removed in order to reduce the likelihood of tick infestation.

II. Supplemental Chemical Control Measures

In situations where adequate vector control is not obtained through prevention and source reduction measures, provision should be made for supplemental use of insecticides and rodenticides to achieve the desired level of control.

III. Vector Appraisal

Arrangements should be made for carrying out a routine program of vector appraisal as a part of normal operations of the reservoir and associated recreational areas. Inspections for adult and larval mosquitoes and other vectors are essential for planning and evaluating control measures and for adjusting control programs to meet temporary or emergency situations.

APPENDIX C

Principles and Practices for Prevention and Elimination of Mosquito Sources Associated with Irrigation

A. Project Conveyance and Distribution Systems

1. Lining or other satisfactory seepage control measures should be provided for all sections of canals and laterals located in porous material where excessive leakage would result in waterlogged areas, seeps, and ponds.

2. Drains should be installed to prevent ponding of excess irrigation water and natural runoff along the upper side of canals and laterals. All drainage crossing or inlet structures should be placed on grade to avoid ponding.

3. Borrow areas should be self-draining to keep them from retaining ponded water.

4. Where possible, provision should be made to prevent turnouts and other hydraulic structures from retaining residual water when they are not being used.

5. Effective measures should be provided to prevent ponding of leakage from water control strucutres.

6. Every effort should be made to establish delivery schedules which will provide farmers with adequate but not excessive amounts of water at proper intervals to insure efficient irrigation of the crops concerned.

7. Vegetation and debris which would retard normal flows should be periodically removed from conveyance channels, water control structures, and drains.

B. Project Drainage Systems

1. Trunk drainage systems should be installed to insure complete removal and proper disposal of excess irrigation water, natural runoff, and seepage from both irrigable and nonirrigable lands affected by the distribution and use of irrigation water on the project.

2. Drainage ditches should be designed, constructed, and maintained so as to minimize ponding in the channels and to insure free flows at all times.

3. Provision should be made to prevent water from ponding behind spoil banks.

4. Underdrains, culverts, inlets, etc., should be placed on grade to prevent ponding.

C. Irrigated Farms

1. The sponsoring agency and other organizations concerned with irrigation agriculture or mosquito control should do everything possible to encourage irrigation farmers to use the following irrigation and drainage practices which will prevent or minimize mosquito sources:

   a. The farm supply system, drainage system, and field layouts should be properly fitted to the topography, soil, water supply, crops to be grown, and irrigation methods to be used.

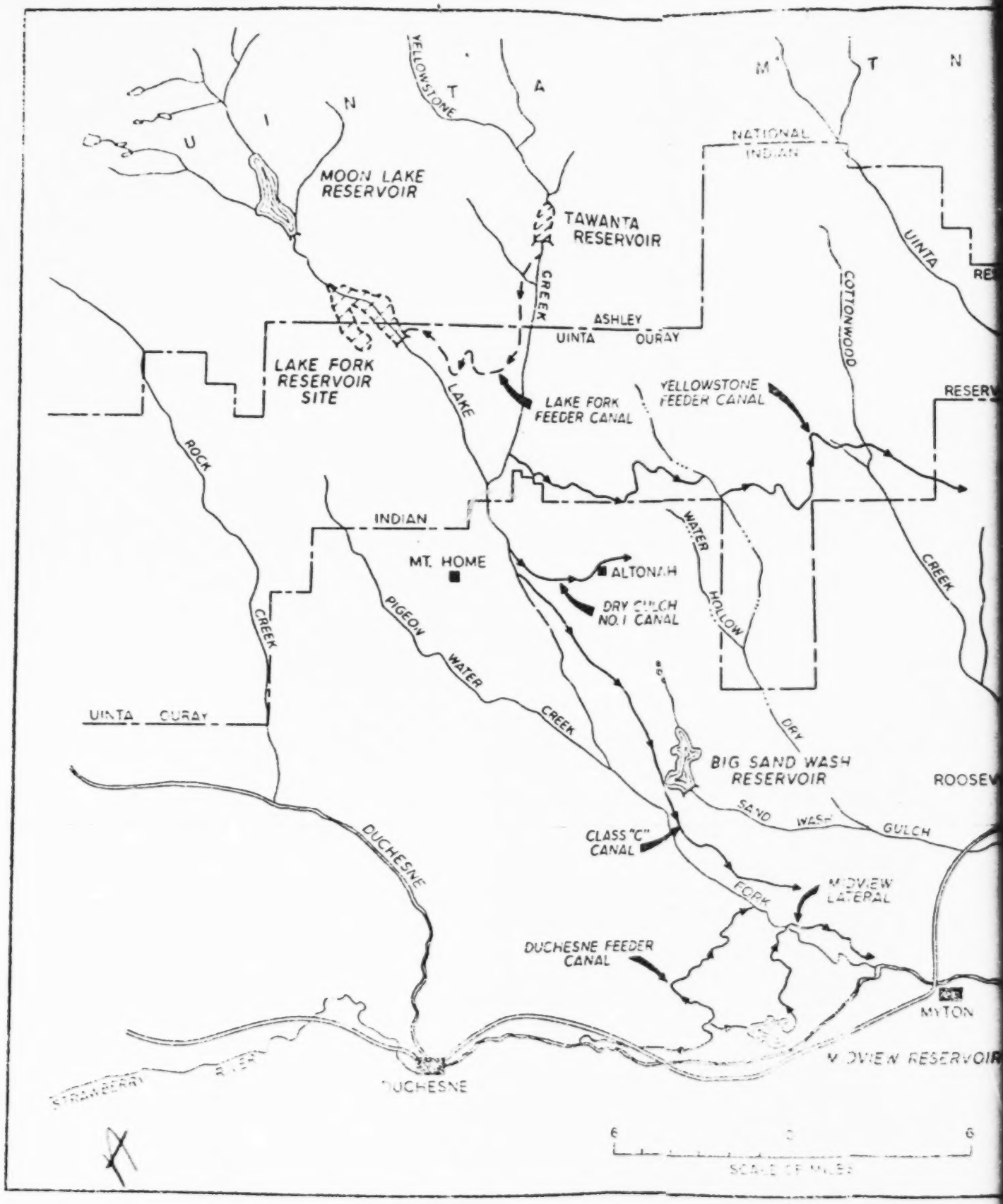
   b. All surface irrigated fields should be properly leveled or graded to provide for efficient water application and removal of excess water without ponding.

   c. An adequate drainage system should be provided for removal of excess water from all portions of the farm.

   d. Irrigation methods should be used which will provide optimum irrigation efficiencies.

   e. Application of irrigation water should be limited to that required to fill the crop root zone plus unavoidable losses and excess water needed to prevent upward movement of salts.

AREA MAP


MOON LAKE RESERVOIR
TAWANTA RESERVOIR
YELLOWSTONE
CREEK
NATIONAL INDIAN
UINTA
COTTONWOOD
ASHLEY
UINTA
OURAY
LAKE FORK RESERVOIR SITE
LAKE FORK FEEDER CANAL
YELLOWSTONE FEEDER CANAL
ROCK
LAKE
INDIAN
MT. HOME
ALTONAH
DRY GULCH NO. 1 CANAL
WATER
HOLLOW
PIGEON
WATER
CREEK
UINTA
OURAY
BIG SAND WASH RESERVOIR
SAND WASH
GULCH
CLASS "C" CANAL
DUCHESNE
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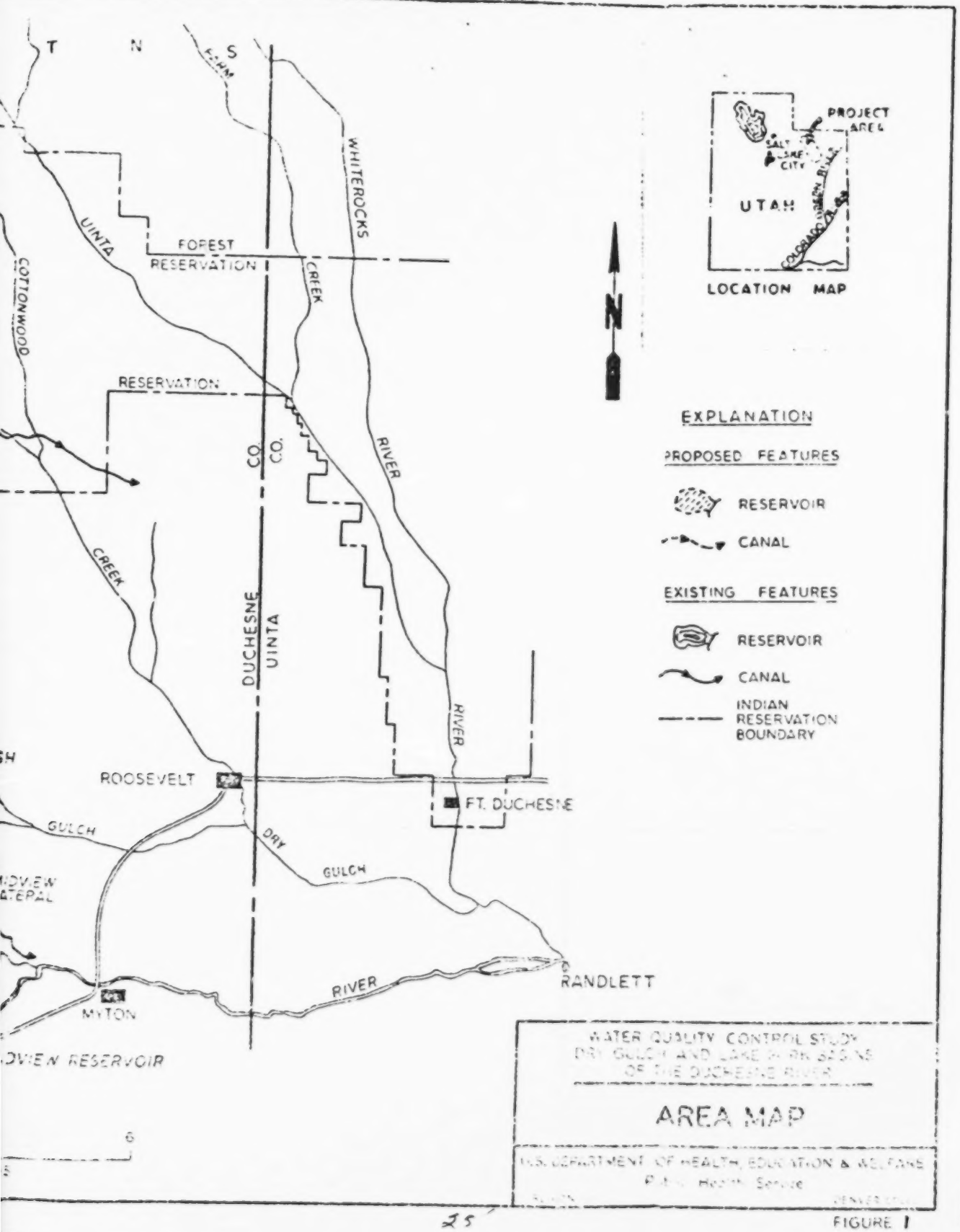

WATER QUALITY CONTROL STUDY
DRY GULCH AND LAKE FORK BASINS
OF THE DUCHESNE RIVER

AREA MAP

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FIGURE 1

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